

WHAT IS CLAIMED IS:

1           1.       A liner retention system for a reciprocating pump having a piston and a piston rod  
2       operating in a cavity of a frame, which system comprises:  
3               a cylindrical liner for said piston and said piston rod, said liner having a radially  
4       extending external shoulder;  
5               a liner clamp plate having a central opening receivable over said liner and a plurality  
6       of stud apertures;  
7               a plurality of studs extending from a module block, each said stud terminating in a  
8       threaded end spaced from said frame;  
9               at least one compression sleeve having an inside diameter larger than an external  
10      diameter of said stud extenders; and  
11              a tensioner to secure each said stud to said liner clamp plate and to thereby secure said  
12      cylindrical liner to said module block.

1           2.       A liner retention system as set forth in Claim 1 wherein said tensioner is a multijack  
2      bolt tensioner.

1           3.       A liner retention system as set forth in Claim 1 wherein at least one said stud includes  
2      a stud extender.

1           4.       A liner retention system as set forth in Claim 3 including two said stud extenders and  
2      two said compression sleeves.

1           5.     A liner retention system as set forth in Claim 1 wherein said liner clamp plate central  
2     opening has a diameter less than a diameter of said radially extending external shoulder.

1           6.     A liner retention system as set forth in Claim 1 wherein said cavity in said frame is  
2     closed on five sides.

1           7.     A liner retention system as set forth in Claim 1 including a hardened washer between  
2     each said compression sleeve and each said tensioning means.

1           8.     A liner retention system for a reciprocating pump having a piston and piston rod  
2     operating in a cavity of a frame wherein said cavity is closed on five sides, which system comprises:  
3                 a cylindrical liner for said piston and said piston rod, said liner having a radially  
4     extending external shoulder;  
5                 a liner clamp plate having a central opening receivable over said liner wherein said  
6     central opening has a diameter less than a diameter of said radially extending shoulder;  
7                 a plurality of studs extending from a module block, each said stud terminating in a  
8     threaded end spaced from said module block, including a pair of stud extenders;  
9                 a pair of compression sleeves having an inside diameter larger than an external  
10    diameter of said stud extender; and  
11                a tensioner to secure each said stud to said liner clamp plate and to thereby secure said  
12    cylindrical liner to said module block.

1           9.     A method to secure and retain a cylindrical liner for a reciprocating pump to a frame,  
2     which method comprises:  
3                 inserting said cylindrical liner in an opening within a cavity of said pump frame;  
4                 sliding a liner clamp plate over said cylindrical liner so that said clamp plate engages  
5     a radially protruding shoulder on said liner and so that a plurality of studs extending from said frame  
6     pass through a plurality of apertures in said clamp plate;  
7                 attaching a stud extender to at least one of said studs, wherein each said stud extender  
8     terminates in a threaded end spaced from a module block;  
9                 sliding a compression sleeve having an internal diameter larger than an external  
10    diameter of said stud extender; and  
11                tensioning each said stud to said clamp plate so that said liner thereby is secured to  
12    said module block.

1           10.    A method as set forth in Claim 9 wherein said steps are performed in reverse order  
2     to remove said cylindrical liner.

1           11.    A method as set forth in Claim 9 wherein said tensioning each said stud to said clamp  
2     plate includes threading a multijack bolt tensioner to each said stud.

1           12.    A method as set forth in claim 9 including the step of reducing the number of said  
2     studs tensioned through use of said method.